SER25330HR/SER35330HR

Isolated Octal Serial Module

User's Manual

BDM-610020099 Rev. F

RTD Embedded Technologies, Inc.
AS9100 and ISO 9001 Certified

RTD Embedded Technologies, Inc.
103 Innovation Boulevard
State College, PA 16803 USA
Telephone: 814-234-8087
Fax: 814-234-5218

www.rtd.com

sales@rtd.com
techsupport@rtd.com

Revision History

Rev A	Initial Release
Rev B	Updated pin out for Table 6, Table 7, Table 8, Table 9
Rev C	Updated Board Features Max Baud Rates
Rev D	Added References to SER35330 Version
Rev E	Added IDAN connector part number and mating connector
Rev F	Updated IDAN connector to board pin out

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1 Introduction

1.1 Product Overview

The SER25330/SER35330 is designed to provide eight independent isolated serial ports that are configurable for RS-232/422/485. The SER25330/SER35330 also provides isolation boundaries between ports that provide up to 2.5KV of isolation.

The SER35330 is the PCIe version of this device that does not have a PCI pass-through connector.

1.2 Board Features

- Eight versatile serial port interfaces
  - Jumper-less selectable RS-232, RS-422 driver always enabled, RS-485 with RTS driver enable and RS-485 with inverted RTS enable operation.
  - Supports all standard RS-232 serial port signals (RTS, CTS, etc.)
  - Functionally Compatible with standard PC 16C550 UARTs
- EXAR XR17V358 Octal PCI Express (PCIe) UART
  - 16C550 compatible register set
  - 256-byte transmit and receive FIFOs
  - Programmable data rate with prescaler
  - Standard PC serial port baud rates supported
  - Up to 10,000,000 baud RS-422/485 (dependent on OS support)
  - Up to 400,000 baud RS-232
- 2.5KV Isolation between serial ports
- PCI Express Bus
  - Provides 2.5 Gbps in each direction
  - Single lane and single Virtual Channel operation
    - Compatible with multi-Virtual Channel chipsets
  - Packetized serial traffic with PCI Express Spilt Completion protocol
  - Data Link Layer Cyclic Redundancy Check (CRC) generator and checker
  - Automatic Retry of bad packets
  - In-band interrupts and messages
  - Message Signaled Interrupt (MSI) support

1.3 Ordering Information

The SER25330/SER35330 is available in the following options:

Table 1: Ordering Options

Part Number	Description
SER25330HR	PCI/104-Express Isolated Octal Serial Port Module(with pass-through PCI)
SER35330HR	PCIe/104 Isolated Octal Serial Port Module(without pass-through PCI)
IDAN-SER25330HR	PCI/104-Express Isolated Octal Serial Port Module in IDAN enclosure
IDAN-SER35330HR	PCIe/104 Isolated Octal Serial Port Module in IDAN enclosure

Note: Throughout this document, SER25330 refers to both the SER25330 and SER35330 unless otherwise noted

The Intelligent Data Acquisition Node (IDAN™) building block can be used in just about any combination with other IDAN building blocks to create a simple but rugged 104™ stack. This module can also be incorporated in a custom-built RTD HiDAN™ or HiDANplus High Reliability Intelligent Data Acquisition Node. Contact RTD sales for more information on our high reliability systems.

1.4 Contact Information

1.4.1 Sales Support

For sales inquiries, you can contact RTD Embedded Technologies sales via the following methods:

Phone: 1-814-234-8087 Monday through Friday, 8:00am to 5:00pm (EST).
E-Mail: sales@rtd.com

1.4.2 Technical Support

If you are having problems with you system, please try the steps in the Troubleshooting section of this manual.

For help with this product, or any other product made by RTD, you can contact RTD Embedded Technologies technical support via the following methods:

Phone: 1-814-234-8087 Monday through Friday, 8:00am to 5:00pm (EST).
E-Mail: techsupport@rtd.com

2 Specifications

2.1 Operating Conditions

Table 2: Operating Conditions

Symbol	Parameter	Test Condition	Min	Max	Unit
V_{cc5}	5V Supply Voltage		4.75	5.25	V
V_{cc3}	3.3V Supply Voltage		n/a	n/a	V
V_{cc12}	12V Supply Voltage		n/a	n/a	V
T_a	Operating Temperature		-40	+85	C
T_s	Storage Temperature		-40	+85	C
RH	Relative Humidity	Non-Condensing	0	90%	%
MTBF	Mean Time Before Failure	Telcordia Issue 2 30°C, Ground benign, controlled		TBD	Hours

2.2 Electrical Characteristics

Table 3: Electrical Characteristics

Symbol	Parameter	Test Condition		Min	Max	Unit
P	Power Consumption	V_{cc5} = 5.0V			TBD	W
I_{cc}	5V Input Supply Current	Active			TBD	mA
PCIe/104 Bus						
	Differential Output Voltage			0.8	1.2	V
	DC Differential TX Impedance			95.2	116.9	Ω
	Differential Input Voltage			0.175	3.3	V
	DC Differential RX Impedance			92.7	115.8	Ω
	Electrical Idle Detect Threshold			61	173	mV
RS-422 or RS-485 Driver DC Characteristics						
	Differential V_{OUT} (no load)				3.3	V
	Differential V_{OUT} (with load)	R = 50 Ω (RS-422)		2		V
		R = 27 Ω (RS-485)		1.5	5	V
	Common-Mode V_{OUT}	R = 27 Ω or 50 Ω			3	V
	Short-Circuit Current			35	250	mA
	Three-State Output Leakage Current	Outputs Disabled	V_{OUT} = 12V		200	µA
			V_{OUT} = -7V	-200		µA
RS-232 Driver DC Characteristics						
	Output Voltage Swing			±5		V
	Output Short-Circuit Current	V_{OUT} = 0V		-60	60	mA
RS-422 or RS-485 Receiver Inputs DC Characteristics						
	Differential Threshold Voltage	-7V≤V_{CM}≤ 12V		-0.2	-0.04	V
	Input Hysteresis	V_{CM} =0V			35	mV
	Input Current	V_{IN} = 12V			0.8	mA
		V_{IN} = -7V		-0.64		mA
	Input Resistance	-7V≤V_{CM}≤ 12V		15		K Ω
RS-232 Receiver Inputs DC Characteristics						
	Input Voltage Range			-25	25	V
	Input Threshold				0.8	V
				2.4		V
	Input Hysteresis				0.5	V
	Input Resistance	V_{IN} = ±15V		3	7	K Ω
Isolation Characteristics						
	Insulation Voltage	1-minute duration			2500	V_{RMS}
	Maximum Working Insulation Voltage				560	V_{PEAK}
	Highest Allowable OverVoltage				4000	V_{PEAK}
	Insulation Resistance	V_{IO} = 500V			$>10^9$	Ω

3 Board Connection

3.1 Board Handling Precautions

To prevent damage due to Electrostatic Discharge (ESD), keep your board in its antistatic bag until you are ready to install it into your system. When removing it from the bag, hold the board at the edges, and do not touch the components or connectors. Handle the board in an antistatic environment, and use a grounded workbench for testing and handling of your hardware.

3.2 Physical Characteristics

- Weight: Approximately 80 g (0.18 lbs.)
- Dimensions: 90.17 mm L x 95.89 mm W (3.550 in L x 3.775 in W)

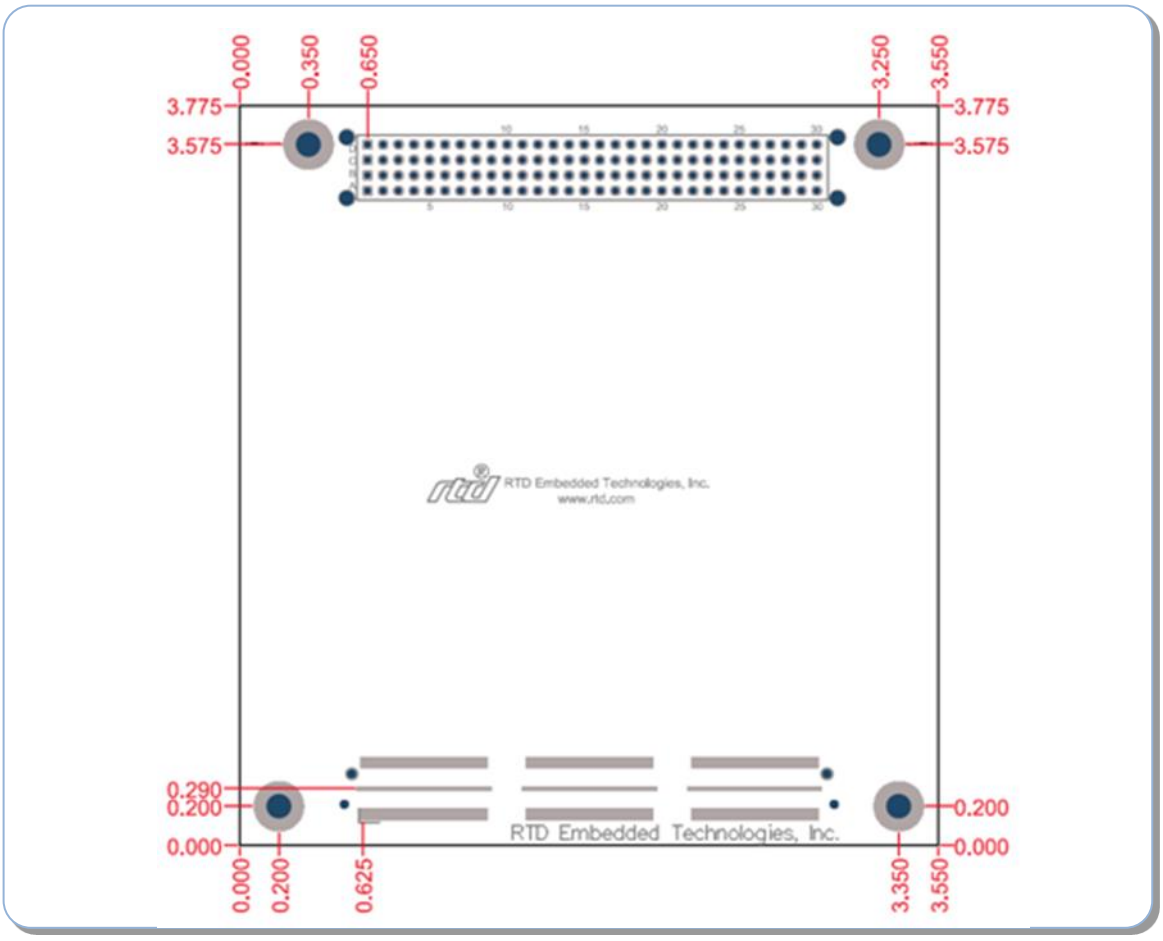


Figure 1: Board Dimensions

3.3 Connectors and Jumpers

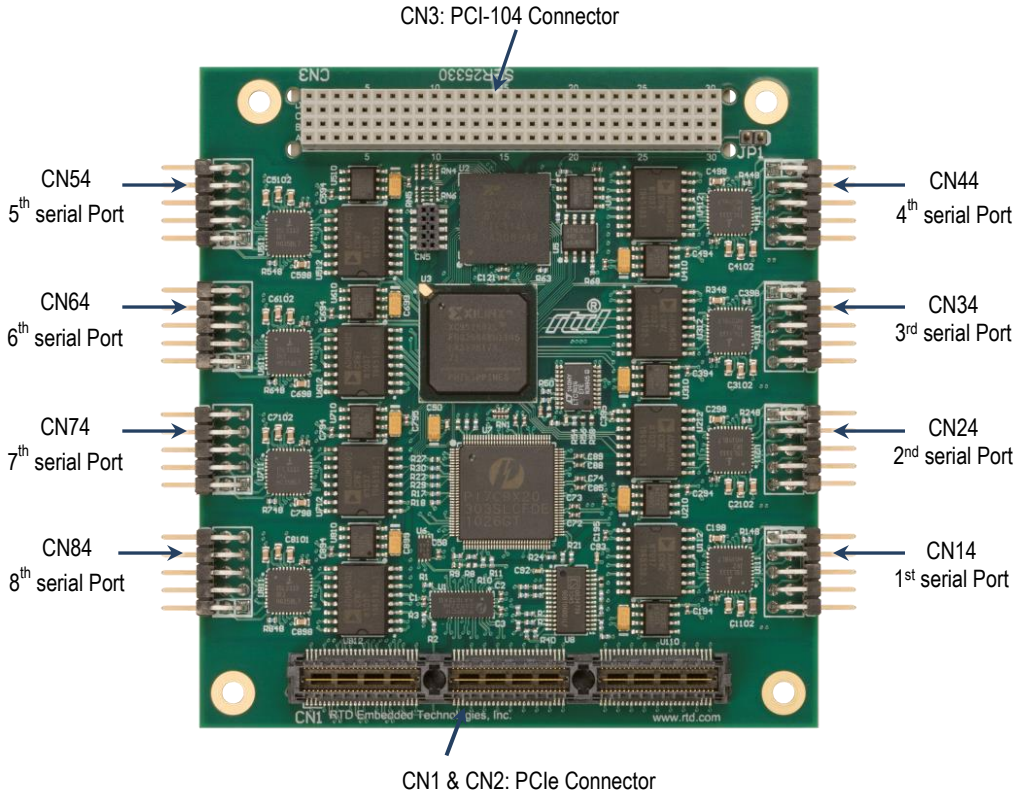


Figure 2: Board Connections

3.3.1 I/O Connectors

Serial Port Connectors: CN14, CN24, CN34, CN44, CN54, CN64, CN74, CN84

Each serial port can be individually configured as a PC compatible full duplex RS-232 port, full duplex RS-422 with drivers always enabled, RS-485 with RTS drivers enable, or RS-485 with inverted RTS driver enable. For more information, refer to Serial Port Configuration.

RS-232 Serial Port Mode (Default)

The full-duplex RS-232 mode is the default setting on the utilityModule. With this mode enabled, serial port must be connected to RS-232 compatible devices. The following table gives the connector pin out and shows how to connect to an external serial connector, either DB25 or DB9.

Table 4 Serial Port Connector in RS-232 Mode (I)

Serial Port Connector	Signal	Function	In/Out	DB25	DB9
1	DCD	Data Carrier Detect	In	8	1
2	DSR	Data Set Ready	In	6	6
3	RXD	Receive Data	In	3	2
4	RTS	Request To Send	Out	4	7
5	TXD	Transmit Data	Out	2	3
6	CTS	Clear To Send	In	5	8
7	DTR	Data Terminal Ready	Out	20	4
8	RI	Ring Indicate	In	22	9
9,10	GND	Signal Ground	--	7	5

Facing the connector pins, the pin out is pictured in the following,

Table 5 Serial Port Connector in RS-232 Mode (II)

9	7	5	3	1
GND	DTR	TXD	RXD	DCD
GND	RI	CTS	RTS	DSR
10	**8**	**6**	**4**	**2**

RS-422, RS-485 RTS, RS-485 Inverted RTS Serial Port Modes

When using RS-422 or RS-485 mode, you can use the port in either half-duplex (two-wire) or full-duplex (four-wire) configurations. For half-duplex (2-wire) operation, you must connect RXD+ to TDX+ and connect RXD- to TXD-.

Note: 120-ohm termination resistor for the RxD- and RxD+ signals are provided on the utilityModule. Termination is usually necessary on all RS-422 receivers and at the ends of the RS-485 bus. If the termination resistor is required, configure the termination settings for the port via software. For more information, refer to the Serial Port Configuration.

The following table gives the pin out of the Serial Port Connector when RS-422 or RS-485 modes are enabled.

Table 6 Connector CN4 in RS-422/485 Mode (I)

Serial Port Connector	Signal	Function	In/Out	DB9
1,2,7,8	RSVD	Reserved	--	--
3	RXD-	Receive Data (-)	In	2
4	TXD+	Transmit Data (+)	Out	7
5	TXD-	Transmit Data (-)	Out	3
6	RXD+	Receive Data (+)	In	8
9,10	GND	Signal Ground	--	5

Facing the connector pins, the pin out is pictured in the following table.

Table 7 Connector CN4 in RS-422/485 Mode (II)

9	7	5	3	1
GND	RSVD	TXD-	RXD-	RSVD
GND	RSVD	RXD+	TXD+	RSVD
10	**8**	**6**	**4**	**2**

3.3.2 BUS CONNECTORS

CN1(Top) & CN2(Bottom): PCIe Connector

The PCIe connector is the connection to the system CPU. The position and pin assignments are compliant with the *PCI/104-Express Specification*. (See PC/104 Specifications on page 24)

The SER25330 is a "Universal" board, and can connect to either a Type 1 or Type 2 PCIe/104 connector.

CN3: PCI Connector

The PCI connector is the connection to PCI peripheral modules. This connector is used only as a pass through connector on this board.

3.3.3 JUMPERS

Jumpers JP1 are for factory use only.

3.4 Steps for Installing

1. Always work at an ESD protected workstation, and wear a grounded wrist-strap.
2. Turn off power to the PC/104 system or stack.
3. Select and install stand-offs to properly position the module on the stack.
4. Remove the module from its anti-static bag.
5. Check that pins of the bus connector are properly positioned.
6. Check the stacking order; make sure all of the busses used by the peripheral cards are connected to the cpuModule.
7. Hold the module by its edges and orient it so the bus connector pins line up with the matching connector on the stack.
8. Gently and evenly press the module onto the PC/104 stack.
9. If any boards are to be stacked above this module, install them.
10. Attach any necessary cables to the PC/104 stack.
11. Re-connect the power cord and apply power to the stack.
12. Boot the system and verify that all of the hardware is working properly.

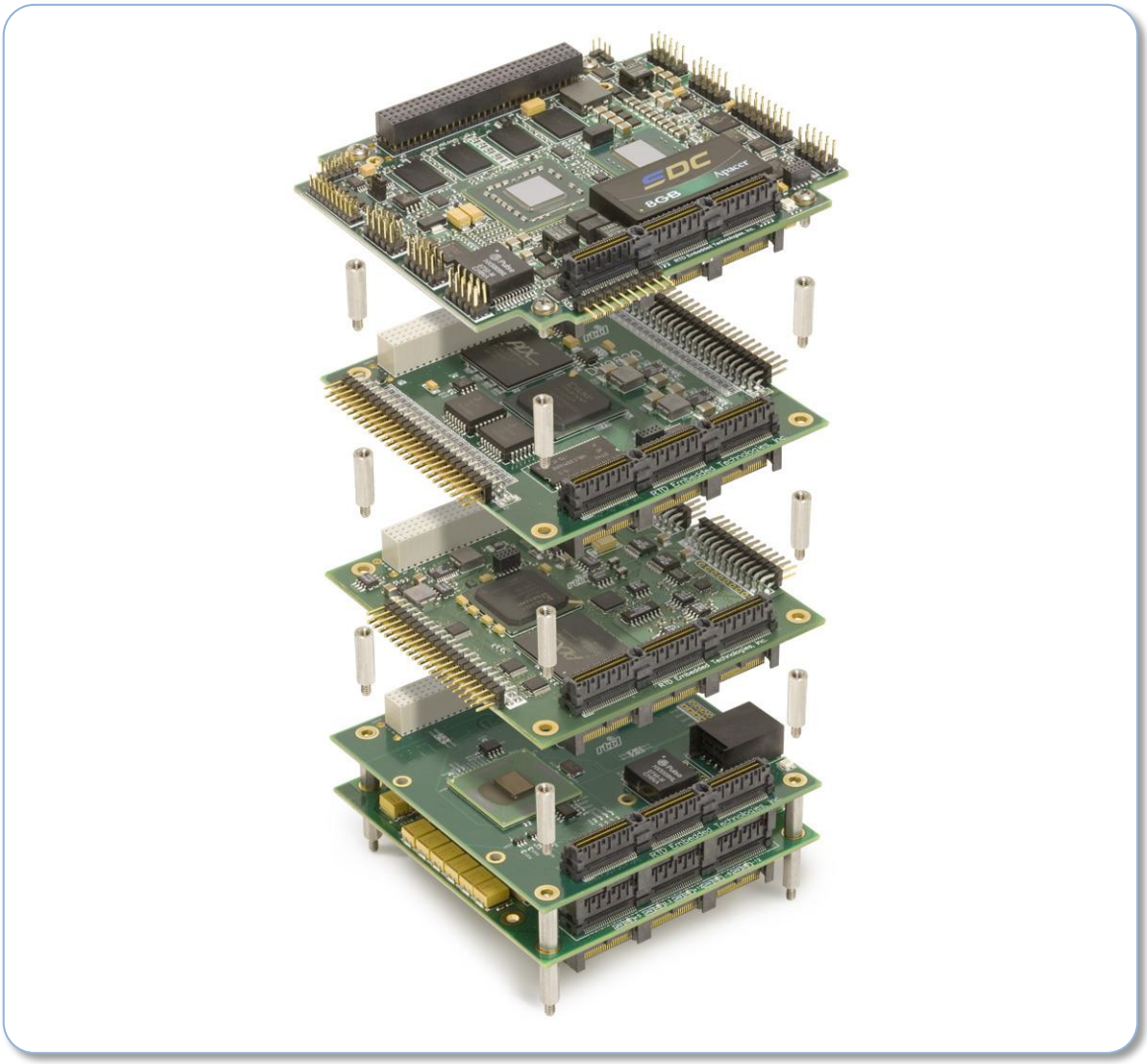


Figure 3: Example 104™ Stack

4 IDAN Connections

4.1 Module Handling Precautions

To prevent damage due to Electrostatic Discharge (ESD), keep your module in its antistatic bag until you are ready to install it into your system. When removing it from the bag, hold the module by the aluminum enclosure, and do not touch the components or connectors. Handle the module in an antistatic environment, and use a grounded workbench for testing and handling of your hardware.

4.2 Physical Characteristics

- Weight: Approximately 0.21 Kg (0.46 lbs.)
- Dimensions: 151.972 mm L x 129.978 mm W x 16.993 mm H (5.983 in L x 5.117 in W x 0.669 in H)

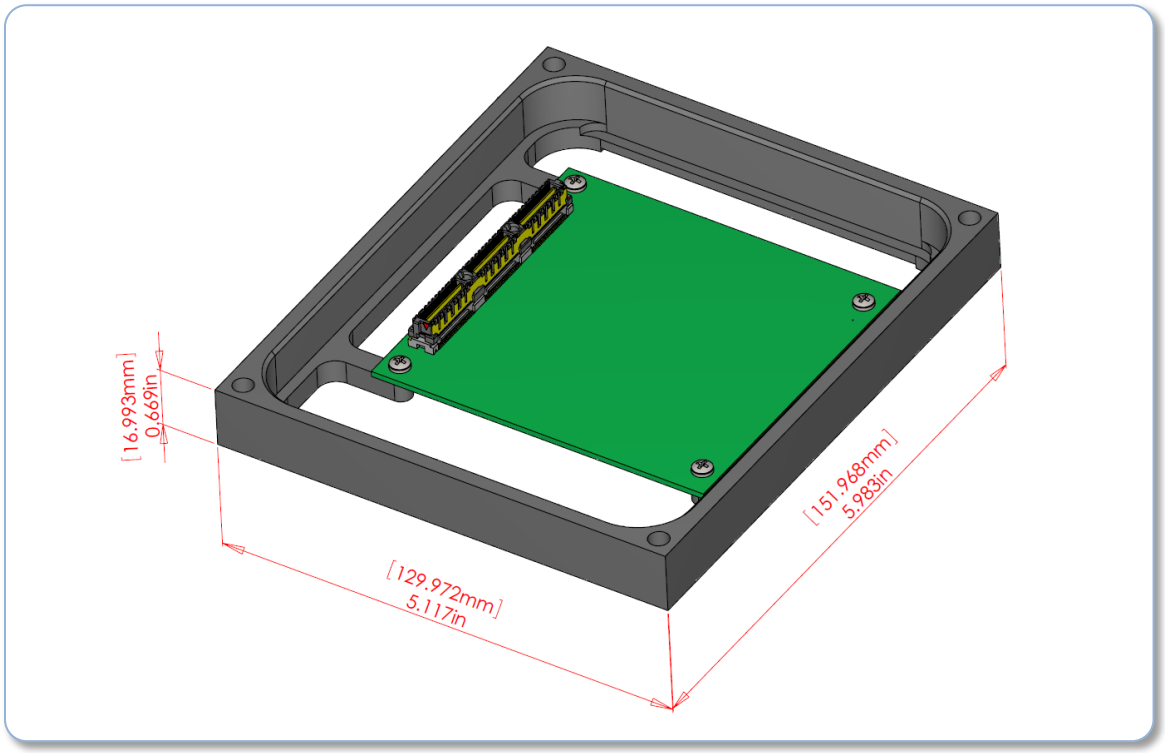


Figure 4: IDAN Dimensions

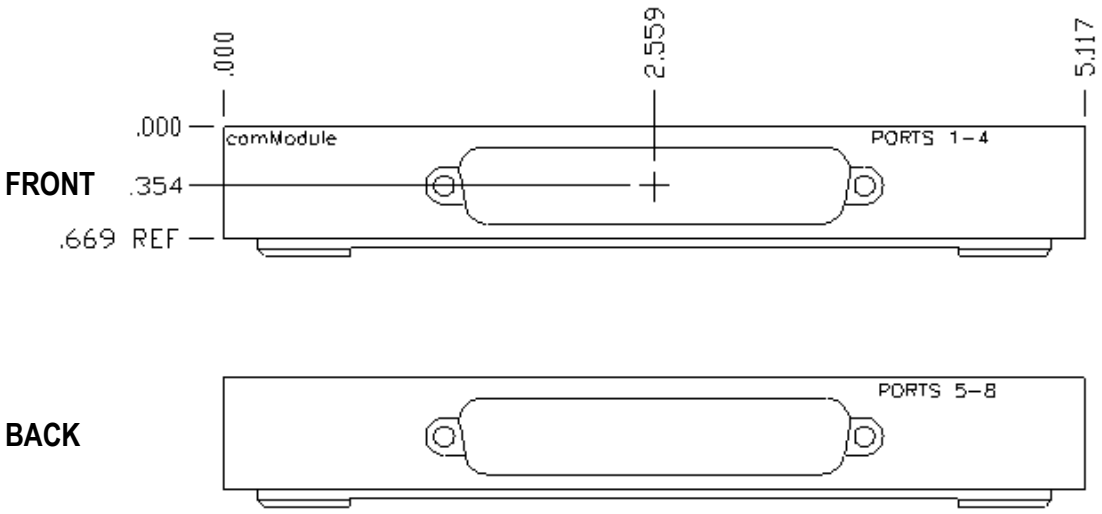
4.3 Connectors

4.3.1 External I/O Connectors

Serial Port Connectors: Ports 1-4 (Front) & Ports 5-8 (Back)

37-pin "D" Female Connectors

Connector Part #: AMP/Tyco 1658610-1 **Example Mating Connector:** AMP/Tyco 1658610-1



Note: Drawings are not to scale.

4.3.1 SERIAL PORTS 1-4 (FRONT)

Table 8 IDAN PORT 1-4

	IDAN Pin #	RS-232 Signal	RS-422/485 Signal	SER25330 Pin #	IDAN-XKCM33 Cable Kit 9 Pin "D" Connector (Male)
Serial Port 4	1	Carrier Detect	--	CN44-1	PORT 4-1
	2	Receive Data	Receive Data (-)	CN44-3	PORT 4-2
	3	Transmit Data	Transmit Data (-)	CN44-5	PORT 4-3
	4	Data Terminal Ready	--	CN44-7	PORT 4-4
	5	GND	GND	CN44-9	PORT 4-5
	20	Data Set Ready	--	CN44-2	PORT 4-6
	21	Request To Send	Transmit Data (+)	CN44-4	PORT 4-7
	22	Clear To Send	Receive Data (+)	CN44-6	PORT 4-8
	23	Ring Indicator	--	CN44-8	PORT 4-9
Serial Port 3	24	Carrier Detect	--	CN34-1	PORT 3-1
	25	Receive Data	Receive Data (-)	CN34-3	PORT 3-2
	26	Transmit Data	Transmit Data (-)	CN34-5	PORT 3-3
	27	Data Terminal Ready	--	CN34-7	PORT 3-4
	28	GND	GND	CN34-9	PORT 3-5
	6	Data Set Ready	--	CN34-2	PORT 3-6
	7	Request To Send	Transmit Data (+)	CN34-4	PORT 3-7
	8	Clear To Send	Receive Data (+)	CN34-6	PORT 3-8
	9	Ring Indicator	--	CN34-8	PORT 3-9
Serial Port 2	10	Carrier Detect	--	CN24-1	PORT 2-1
	11	Receive Data	Receive Data (-)	CN24-3	PORT 2-2
	12	Transmit Data	Transmit Data (-)	CN24-5	PORT 2-3
	13	Data Terminal Ready	--	CN24-7	PORT 2-4
	14	GND	GND	CN24-9	PORT 2-5
	29	Data Set Ready	--	CN24-2	PORT 2-6
	30	Request To Send	Transmit Data (+)	CN24-4	PORT 2-7
	31	Clear To Send	Receive Data (+)	CN24-6	PORT 2-8
	32	Ring Indicator	--	CN24-8	PORT 2-9
Serial Port 1	33	Carrier Detect	--	CN14-1	PORT 1-1
	34	Receive Data	Receive Data (-)	CN14-3	PORT 1-2
	35	Transmit Data	Transmit Data (-)	CN14-5	PORT 1-3
	36	Data Terminal Ready	--	CN14-7	PORT 1-4
	37	GND	GND	CN14-9	PORT 1-5
	15	Data Set Ready	--	CN14-2	PORT 1-6
	16	Request To Send	Transmit Data (+)	CN14-4	PORT 1-7
	17	Clear To Send	Receive Data (+)	CN14-6	PORT 1-8
	18	Ring Indicator	--	CN14-8	PORT 1-9
	19	N/C	N/C	N/C	N/C

4.3.2 SERIAL PORTS 5-8 (BACK)

Table 9 IDAN PORT 4-8

	IDAN Pin #	RS-232 Signal	RS-422/485 Signal	CM17320 Pin #	IDAN-XKCM33 Cable Kit 9 Pin "D" Connector (Male)
Serial Port 8	1	Carrier Detect	--	CN84-1	PORT 8-1
	2	Receive Data	Receive Data (-)	CN84-3	PORT 8-2
	3	Transmit Data	Transmit Data (-)	CN84-5	PORT 8-3
	4	Data Terminal Ready	--	CN84-7	PORT 8-4
	5	GND	GND	CN84-9	PORT 8-5
	20	Data Set Ready	--	CN84-2	PORT 8-6
	21	Request To Send	Transmit Data (+)	CN84-4	PORT 8-7
	22	Clear To Send	Receive Data (+)	CN84-6	PORT 8-8
	23	Ring Indicator	--	CN84-8	PORT 8-9
Serial Port 7	24	Carrier Detect	--	CN74-1	PORT 7-1
	25	Receive Data	Receive Data (-)	CN74-3	PORT 7-2
	26	Transmit Data	Transmit Data (-)	CN74-5	PORT 7-3
	27	Data Terminal Ready	--	CN74-7	PORT 7-4
	28	GND	GND	CN74-9	PORT 7-5
	6	Data Set Ready	--	CN74-2	PORT 7-6
	7	Request To Send	Transmit Data (+)	CN74-4	PORT 7-7
	8	Clear To Send	Receive Data (+)	CN74-6	PORT 7-8
	9	Ring Indicator	--	CN74-8	PORT 7-9
Serial Port 6	10	Carrier Detect	--	CN64-1	PORT 6-1
	11	Receive Data	Receive Data (-)	CN64-3	PORT 6-2
	12	Transmit Data	Transmit Data (-)	CN64-5	PORT 6-3
	13	Data Terminal Ready	--	CN64-7	PORT 6-4
	14	GND	GND	CN64-9	PORT 6-5
	29	Data Set Ready	--	CN64-2	PORT 6-6
	30	Request To Send	Transmit Data (+)	CN64-4	PORT 6-7
	31	Clear To Send	Receive Data (+)	CN64-6	PORT 6-8
	32	Ring Indicator	--	CN64-8	PORT 6-9
Serial Port 5	33	Carrier Detect	--	CN54-1	PORT 5-1
	34	Receive Data	Receive Data (-)	CN54-3	PORT 5-2
	35	Transmit Data	Transmit Data (-)	CN54-5	PORT 5-3
	36	Data Terminal Ready	--	CN54-7	PORT 5-4
	37	GND	GND	CN54-9	PORT 5-5
	15	Data Set Ready	--	CN54-2	PORT 5-6
	16	Request To Send	Transmit Data (+)	CN54-4	PORT 5-7
	17	Clear To Send	Receive Data (+)	CN54-6	PORT 5-8
	18	Ring Indicator	--	CN54-8	PORT 5-9
	19	N/C	N/C	N/C	N/C

4.4 Steps for Installing

1. Always work at an ESD protected workstation, and wear a grounded wrist-strap.
2. Turn off power to the IDAN system.
3. Remove the module from its anti-static bag.
4. Check that pins of the bus connector are properly positioned.
5. Check the stacking order; make sure all of the busses used by the peripheral cards are connected to the cpuModule.
6. Hold the module by its edges and orient it so the bus connector pins line up with the matching connector on the stack.
7. Gently and evenly press the module onto the IDAN system.
8. If any boards are to be stacked above this module, install them.
9. Finish assembling the IDAN stack by installing screws of an appropriate length.
10. Attach any necessary cables to the IDAN system.
11. Re-connect the power cord and apply power to the stack.
12. Boot the system and verify that all of the hardware is working properly.

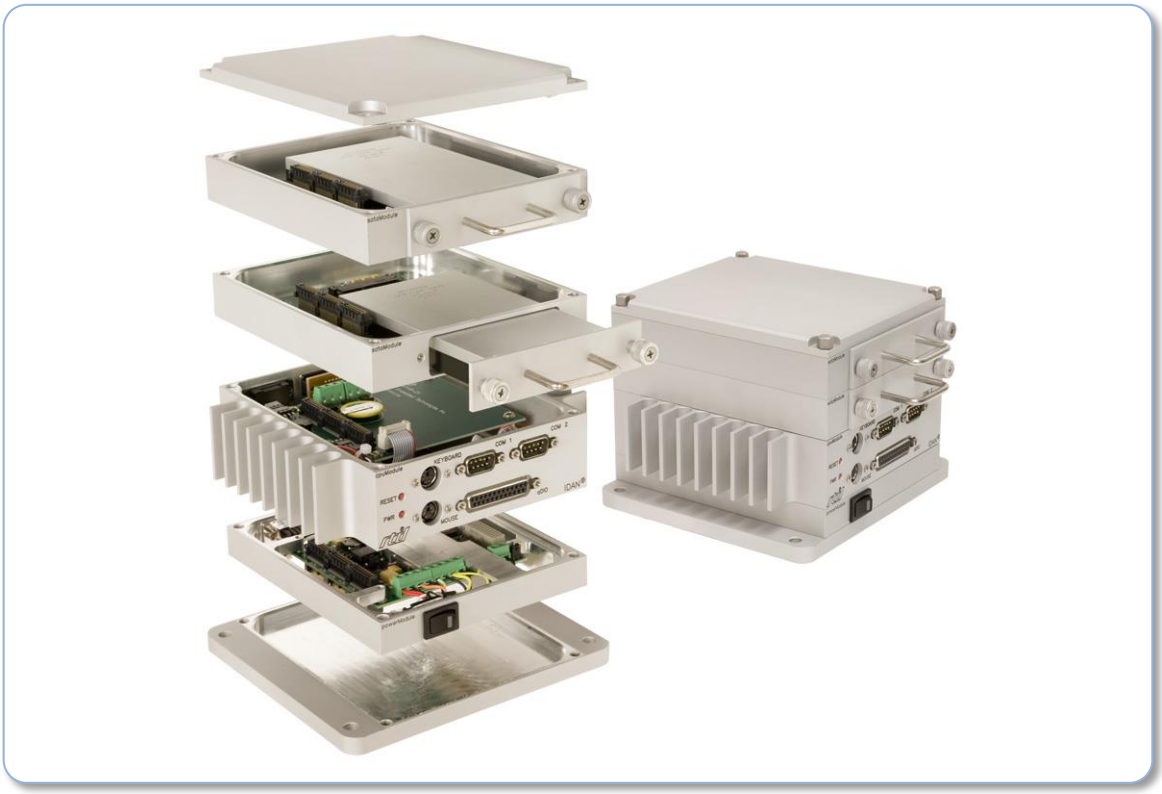


Figure 5: Example IDAN System

5 Functional Description

5.1 Block Diagram

The Figure below shows the functional block diagram of the SER25330. The various parts of the block diagram are discussed in the following sections.

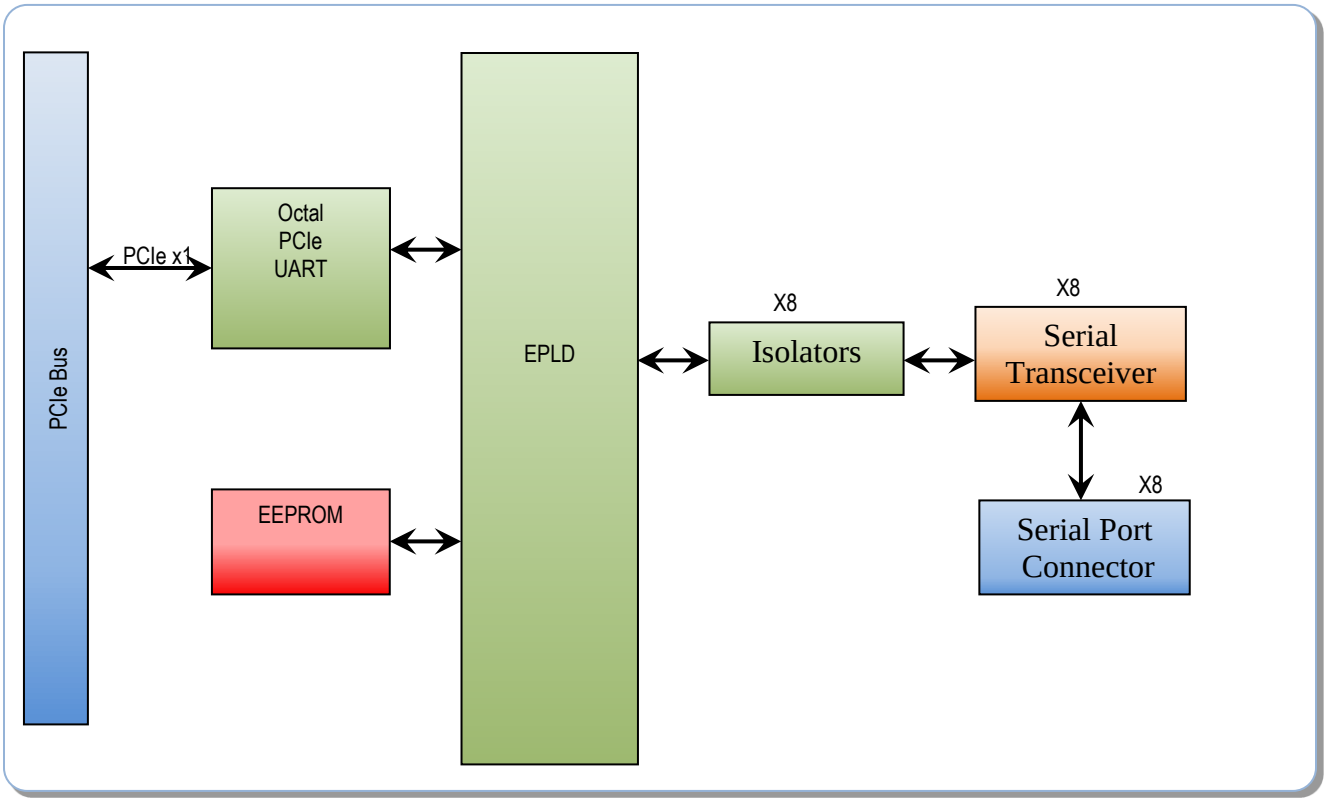


Figure 6: SER25330 Block Diagram

5.2 Octal PCIe UART

The SER25330 uses an octal PCIe UART to provide eight individually controlled serial port. The UART also provides a serial bus to allow for communication to the ELPD to configure the serial ports via software.

5.3 Isolators

The SER25330 uses ADUM5402, Quad-Channel Isolators. These Isolators provide isolation of signals and a built in DC to DC Converter to allow for up 2.5KV of isolation between ports.

5.4 Serial Ports

The SER25330 has 8 individually controlled serial ports each with their own serial transceiver allowing each port to operate in different modes and baud rates. Each serial port also has independent termination control.

6 Software

6.1 Installing the Software

The SER25330 use a PCIe UART which will require software and drivers for proper operation. Drivers are provided for Windows XP/7, DOS, and Linux Kernel 2.6.37 and newer.

The drivers are provided on the companion CD and are also available on the RTD web site (http://www.rtd.com) for download.

6.2 Serial Port Configuration

A software utility is required to configure serial port mode and termination setting. This utility along with source code for the utility is provided on the companion CD and is also available on the RTD web site (http://www.rtd.com) for download.

For additional support concerning the software utility please contact RTD tech support.

6.3 Software Programming

6.3.1 API Interface

Once the drivers for the SER25330 have been properly loaded, all eight RS-232/422/485 ports should be available as standard serial ports. All eight ports can then be controlled using the standard serial port interfaces built into the operating system.

A description of serial port programming for operating systems is beyond the scope of this manual. Consult the operating system documentation for information on how to interface with serial ports via software.

6.3.2 COM Port Numbering

Serial ports (aka COM ports) are typically assigned numbers by the operating system (e.g. COM1). These numbers are typically dynamically assigned by the operating system. However, different applications may enumerate the COM ports differently, assigning different port numbers (e.g. COM3-10 vs COM5-12). When developing your own serial port application, consult your operating system's documentation for the proper method of enumerating COM ports.

Note:	Some applications are written to assume that no more than four COM ports are present in a system. These applications may have compatibility issues with the Exar PCIe UART.

6.3.3 Base Address and Register Mapping

The SER25330 exposes all of the registers available on the Exar XR17V358. The register set of the XR17V358 mimics the standard 16C550 UART register map. However, the XR17V358 contains some additional registers not found in a typical ISA-based UART.

Additionally, the base address of the SER25330's serial ports will be different than the standard PC serial port locations (0x3F8, 0x2F8, etc). The SER25330 is a memory mapped device. Since it is PCI-based, it may be mapped to any location within the 4GB address space of the CPU. The base address of PCI devices is determined by the CPU's BIOS and operating system at boot time.

The register-level differences between the SER25330 and a standard 16C550 UART should be abstracted via the software drivers. Most users will not need to concern themselves with the actual registers of the board. If one is interested in directly accessing the registers of the board, consult the XR17V358 data sheet available from Exar.

6.3.4 Enabling the RS-422/485 Transmitter

When using the serial port in RS-422 or RS485 mode, the serial receiver for RXD (received data) is always enabled.

In RS-422 mode the driver is always enabled, however in RS-485 mode the driver for TXD (transmit data) is enabled and disabled under software control in the following two ways.

In RS-485 RTS driver enable mode the transmitter is enabled by manipulating the Request to Send (RTS) signal of the serial port controller. This signal is controlled by writing bit 1 of the Modem Control Register (MCR) as follows:

- If MCR bit 1 = 1, then RTS = 0, and serial transmitter is disabled
- If MCR bit 1 = 0, then RTS = 1, and serial transmitter is enabled

If you are using the RS-485 inverted RTS driver enable mode these settings will be reversed as follows:

- If MCR bit 1 = 1, then RTS = 0, and serial transmitter is enabled
- If MCR bit 1 = 0, then RTS = 1, and serial transmitter is disabled

If you are using the handshaking signals in RS-422/485 mode, the serial receiver for CTS (clear to send) is always enabled, and the serial transmitter for RTS (request to send) is always enabled.

The exact software method for toggling RTS will depend on your operating system. Consult your operating systems programming documentation for information on how to do this.

NOTE: Many serial communication programs (e.g. Windows HyperTerminal) do not assert RTS while transmitting. When using these programs, make sure the port's configuration enables the transmitters all the time is installed. If using a multi-drop bus such as RS485, the software will have to be modified to toggle RTS to enable the transmit drivers.

7 Troubleshooting

If you are having problems with your system, please try the following initial steps:

- **Simplify the System** – Remove modules one at a time from your system to see if there is a specific module that is causing a problem. Perform you troubleshooting with the least number of modules in the system possible.

- **Swap Components** – Try replacing parts in the system one at a time with similar parts to determine if a part is faulty or if a type of part is configured incorrectly.

If problems persist, or you have questions about configuring this product, contact RTD Embedded Technologies via the following methods:

Phone: +1-814-234-8087
E-Mail: techsupport@rtd.com

Be sure to check the RTD web site (http://www.rtd.com) frequently for product updates, including newer versions of the board manual and application software.

8 Additional Information

8.1 PC/104 Specifications

A copy of the latest PC/104 specifications can be found on the webpage for the PC/104 Embedded Consortium:

www.pc104.org

8.2 PCI and PCI Express Specification

A copy of the latest PCI and PCI Express specifications can be found on the webpage for the PCI Special Interest Group:

www.pcisig.com

8.3 Exar XR17V358 PCIe Bus Octal UART

For detailed information about the Exar XR17V358, contact Exar at:

www.exar.com

9 Limited Warranty

RTD Embedded Technologies, Inc. warrants the hardware and software products it manufactures and produces to be free from defects in materials and workmanship for one year following the date of shipment from RTD Embedded Technologies, Inc. This warranty is limited to the original purchaser of product and is not transferable.

During the one year warranty period, RTD Embedded Technologies will repair or replace, at its option, any defective products or parts at no additional charge, provided that the product is returned, shipping prepaid, to RTD Embedded Technologies. All replaced parts and products become the property of RTD Embedded Technologies. Before returning any product for repair, customers are required to contact the factory for a Return Material Authorization (RMA) number.

This limited warranty does not extend to any products which have been damaged as a result of accident, misuse, abuse (such as: use of incorrect input voltages, improper or insufficient ventilation, failure to follow the operating instructions that are provided by RTD Embedded Technologies, “acts of God” or other contingencies beyond the control of RTD Embedded Technologies), or as a result of service or modification by anyone other than RTD Embedded Technologies. Except as expressly set forth above, no other warranties are expressed or implied, including, but not limited to, any implied warranties of merchantability and fitness for a particular purpose, and RTD Embedded Technologies expressly disclaims all warranties not stated herein. All implied warranties, including implied warranties for merchantability and fitness for a particular purpose, are limited to the duration of this warranty. In the event the product is not free from defects as warranted above, the purchaser's sole remedy shall be repair or replacement as provided above. Under no circumstances will RTD Embedded Technologies be liable to the purchaser or any user for any damages, including any incidental or consequential damages, expenses, lost profits, lost savings, or other damages arising out of the use or inability to use the product.

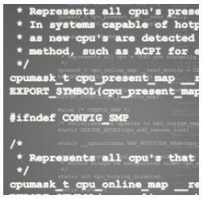
Some states do not allow the exclusion or limitation of incidental or consequential damages for consumer products, and some states do not allow limitations on how long an implied warranty lasts, so the above limitations or exclusions may not apply to you.

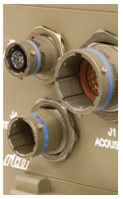
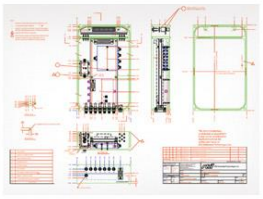
This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

RTD Embedded Technologies, Inc.
103 Innovation Boulevard
State College, PA 16803 USA
Telephone: 814-234-8087
Fax: 814-234-5218

www.rtd.com

sales@rtd.com
techsupport@rtd.com



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